

## WEBQUIZ: WEB QUIZZES USING L<sup>A</sup>T<sub>E</sub>X

WEBQUIZ will process this quiz using **pst2pdf**.

**Introduction** (Introduction) WebQuiz is a L<sup>A</sup>T<sub>E</sub>X package for creating *interactive* web quizzes. The idea is that you write the quiz using L<sup>A</sup>T<sub>E</sub>X and that WebQuiz creates the web page from this file. Anything that you can write using L<sup>A</sup>T<sub>E</sub>X will be converted to **HTML** by WebQuiz. This includes, for example, mathematics and graphics written using **pstricks**. WebQuiz supports three different types of quiz questions:

1. Multiple choice questions with a *unique* correct answer. (See [button to to question 1](#))
2. Multiple choice questions with *several* (or no) correct answers. (See [button to to question 2](#))
3. Questions that require the student to enter an answer, which can then be compared with the correct answer in several different ways. (See [button to to question 3](#))

The use of WebQuiz is described in the next section. Later sections describe how each of the WebQuiz environments are used.

The **discussion** environment in WebQuiz can also be used to write Web Pages like this one (The pages you are reading here were written using WebQuiz.)

**Basic Usage** (Basic Usage) Once you have a WebQuiz file, you can run it through L<sup>A</sup>T<sub>E</sub>X, in the usual way, to produce a readable version of your quiz. When you are happy with the quiz, use WebQuiz to create the HTML version. Note that the printable version of the quiz does *not* look like the web page; rather, it contains all of the information in an easily readable layout.

If, for example, your quiz file is called *quiz1.tex* then you can use the following commands:

```
> latex quiz1           % latex a quiz file
> pdflatex quiz1        % a PDF versio of the quiz
> xdvi quiz1            % view the quiz using xdvi
> dvips quiz1           % print the quiz
> webquiz quiz1         % converts the quiz to html
```

Converting the quiz to html can take quite a long time, particularly if a large number of images need to be created.

### WebQuiz files (WebQuiz files)

The basic structure of a WebQuiz file is as follows:

```
\documentclass{webquiz}

\title{Quiz 1: Complex numbers}

\UnitCode{MATH1001}
\UnitName{Differential Calculus}
\UnitURL{/u/UG/JM/MATH1001/}
\QuizzesURL{/u/UG/JM/MATH1001/Quizzes/}

\begin{document}

\begin{discussion}[short heading][optional heading]
. . . % optional discussion
\end{discussion}

\begin{question} % question 1
. . .
\end{question}

\begin{question} % question 2
. . .
\end{question}

.
.
\end{document}
```

In the preamble of the L<sup>A</sup>T<sub>E</sub>X file you can specify the unit code, the name of the unit of study, the location of the homepage for the unit and the index file for the quizzes for this unit; this is done using the commands `\UnitCode`, `\UnitName`, `\UnitURL` and `\QuizzesURL` respectively. If the command `\QuizzesURL` is omitted then the URL for the quiz index file is set to `\UnitURL/Quizzes`.

The title of the quiz can be set in the preamble using the `\title` command. Note that the `\title` command *must* appear before the `\begin{document}` command. As in any L<sup>A</sup>T<sub>E</sub>X document, the preamble can define macros and load other L<sup>A</sup>T<sub>E</sub>X packages the usual way .

By using the `discussion` environment you can summarise the material for the students or add introductory material for the quiz. For example, `discussion` environments can be used to recall that main concepts being covered by the quiz or to give references to the lecture notes for the unit. The syntax for the

`discussion` environment is as follows:

```
\begin{discussion}[optional short heading][optional heading]
. . .
\end{discussion}
```

Anything you like (text, mathematics, ...) can go inside discussion environments. The *optional heading*, which defaults to "Discussion", is used both as the section heading on the web page and as the heading in the side-menu on left hand side of the page. If a *short heading* is also given then it is used in the side-menu. The quiz can contain zero or more discussion items ( and zero or more quiz questions).

Questions are set inside a `question` environment. The text is followed by the answers.

WebQuiz supports three types of questions:

- Multiple choice questions with *precisely one* correct answer;
- Multiple choice questions with *zero or more* correct answers;
- Questions that require the students to enter an answer. Five difference comparison methods are available.

With each of these types of questions you can (and should) provide feedback to the students depending on whether their answer is correct or incorrect. Below we describe how to produce these different types of questions.

**Question 1** (Question 1) The syntax for a multiple choice question having *precisely one* correct answer is as follows:

```
\begin{question}
. . .question text
\begin{choice}
\(\text{in})\text{correct} . . . text for (\text{in})\text{correct} option
\feedback . . . feedback on response

\(\text{in})\text{correct} . . . text for (\text{in})\text{correct} option
\feedback . . . feedback on response
.
.
.
\end{choice}
\end{question}
```

The different choices in a multiple choice question must be inside a `choice` environment. This environment behaves like a standard L<sup>A</sup>T<sub>E</sub>X list environment except that instead of using `\item` for list item you use:

- `\correct` for a correct choice
- `\incorrect` for an incorrect choice
- `\feedback` to give feedback to the student when they select this choice

At most one `\feedback` response should be given for each `\correct` and each `\incorrect` response. The `\feedback` commands are optional; however, it is recommended that you use them because targeted feedback to the students based on their responses can be beneficial.

For example, the code below, when run through WebQuiz, produces button to to question 1 in the online manual quiz.

```
\begin{question}
The shaded region in the graph
\begin{center}
\begin{pspicture}(-3,-1.5)(3,4)
\pscircle[linewidth=1pt,linestyle=dashed,%
fillcolor=SkyBlue,fillstyle=solid](1,1){2}
\psaxes[linecolor=red,linewidth=1pt,labels=none]%
{->}(0,0)(-1.5,-1.5)(3.5,3.5)
\rput(3.75,0){$x$}
\rput(0,3.85){$y$}
\rput(3,-0.4){3}
\rput(-0.4,3){3i}
\psdots(1,1)
\end{pspicture}
\end{center}
is equal to which of the following sets of complex numbers?
\begin{choice}
\incorrect $\{z \in \mathbb{C} : (z-1)^2+(z-(i+1))^2<2\}$
\feedback The equation of a circle in the complex plane with
centre $a+ib$ and radius $r$ is
\begin{displaymath}
\{z \in \mathbb{C} : |z-(a+ib)|<r\}.
\end{displaymath}

\incorrect $\{z \in \mathbb{C} : z+(i+1)<2\}$
\feedback You want the set of points whose \textit{distance}
from $1+i$ is less than $2$.

\correct $\{z \in \mathbb{C} : |z-(i+1)|<2\}$
\feedback The graph shows the set of complex numbers whose
distance from $1+i$ is less than $2$.

\incorrect $\{z \in \mathbb{C} : |z-2|<|i+1-2|\}$
\feedback As $|i+1-2|=\sqrt{2}$, this is the set of complex
numbers whose distance from $2$ is less than
$\sqrt{2}$.
```

```

\incorrect None of the above.
\feedback The graph shows the set of complex numbers whose
distance from the centre of the circle is less than  $2\sqrt{2}$ .
\end{choice}
\end{question}

```

**Question 2** (Question 2) To allow multiple (or no) correct answer we add `multiple` as an optional argument to the `choice` environment:

```

\begin{question}
. . .question text. . .
\begin{choice}[multiple]
  \((in)correct . . . text for (in)correct option
  \feedback . . . feedback on response

  \((in)correct . . . text for (in)correct option
  \feedback . . . feedback on response
  .
  .
  .
\end{choice}
\end{question}

```

The only difference to the previous case is that zero or more `\correct` commands can appear.

For example, button to to question 2 below was typed into WebQuiz using the following commands:

```

\begin{question}
Which of the following numbers are prime?
\begin{choice}[multiple]
  \incorrect 1
  \feedback By definition, a prime is a number greater than 1
  whose only factors are 1 and itself.

  \correct 19
  \feedback The only factors of 19 are 1 and itself.

  \incorrect 6
  \feedback 2 is a factor of 6

  \correct 23
  \feedback The only factors of 23 are 1 and itself.

  \correct 191
  \feedback The only factors of 191 are 1 and itself.
\end{choice}
\end{question}

```

**Question 3** (Question 3)

By default, the `choice` environments puts the multiple choice options into one column format. Sometimes the options look better when listed in two or more columns, however, this should be used sparingly as multiple columns do not always display well if the quiz is viewed on a mobile device. By using the `columns` key word in a `choice` environment you can specify the number of columns in the HTML version of the quiz.

```
\begin{question}
. . .question text. . .
\begin{choice}[multiple, columns=n] . . . n columns
\ (in)correct . . . text for (in)correct option
\feedback . . . feedback on response

\ (in)correct . . . text for (in)correct option
\feedback . . . feedback on response
.
.
.
\end{choice}
\end{question}
```

If the optional argument `[multiple]` is not present, then the question admits precisely one correct answer.

For example, button to to question 3 below was typed into WebQuiz using the following commands:

```
\begin{question}
What are suitable parametric equations for this plane curve?
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-2.5,-0.5)(5,5.5)
\psaxes[linecolor=red,linewidth=1pt,labels=none]%
{->}(0,0)(-2.5,-1.5)(5,5)
\psellipse[linecolor=SkyBlue,linewidth=2pt](1,2)(3,2)
\end{pspicture}
\end{center}

\begin{choice}[columns=1]
\incorrect  $x=2\cos t + 1$ ,  $y=3\sin t + 2$ 
\feedback This is an ellipse with centre  $(1,2)$  and with axes of
length  $4$  in the  $x$ -direction and  $6$  in the  $y$ -direction.
\begin{center}
\psset{unit=.6cm}
\begin{pspicture}(-2.5,-0.5)(5,5.5)
\psaxes[linecolor=red,linewidth=1pt,labels=none]%
{->}(0,0)(-2.5,-1.5)(5,5)
\parametricplot[linecolor=SkyBlue,linewidth=2pt]{0}{360}%
```

```

        {t cos 2 mul 1 add t sin 3 mul 2 add}
    \end{pspicture}
\end{center}

\correct $x=3\cos t + 1$, $y=2\sin t + 2$
\feedback The curve is an ellipse centre (1,2) with axes length 6
in the $x$ direction and 4 in the $y$ direction.

\incorrect $x=3\cos t - 1$, $y=2\sin t - 2$
\feedback This is an ellipse with centre  $(-1,-2)$  and with axes
of length 6 in the  $x$ -direction and 4 in the  $y$ -direction.
\begin{center}
    \psset{unit=.6cm}
    \begin{pspicture}(-5,-4)(1,2)
        \psaxes[linecolor=red,linewidth=1pt,labels=none]%
        {<-}(0,0)(-4.5,-5.5)(1,2)
        \parametricplot[linecolor=SkyBlue,linewidth=2pt]{0}{360}%
        {t cos 3 mul 1 sub t sin 2 mul 2 sub}
    \end{pspicture}
\end{center}

\incorrect $x=2\cos t - 1$, $y=3\sin t - 2$
\feedback This is an ellipse with centre  $(-1,-2)$  and with axes
of length 4 in the  $x$ -direction and 6 in the  $y$ -direction.
\begin{center}
    \psset{unit=.6cm}
    \begin{pspicture}(-4,-5)(1,2)
        \psaxes[linecolor=red,linewidth=1pt,labels=none]%
        {<-}(0,0)(-4.5,-5.5)(1,2)
        \parametricplot[linecolor=SkyBlue,linewidth=2pt]{0}{360}%
        { t cos 2 mul 1 sub t sin 3 mul 2 sub}
    \end{pspicture}
\end{center}
\end{choice}
\end{question}

```

**Question 4** (Question 4) The final type of question that WebQuiz supports is a question that requires an answer, which can be a number or a string. The answer is typeset using the `\answer` macro. The `\answer` macro takes two arguments: an optional comparison method, which defaults to `string`, and the correct answer for the question:

```
\answer[comparison method]{correct answer}
```

Feedback for correct and incorrect answers is given using the macros `\whenRight` and `\whenWrong`, respectively. The structure of questions with `\answer`'s is as follows:

```

\begin{question}
. . .question text. . .
\answer[*][complex|integer|lowercase|number|string]{actual answer}
\whenRight . . . feedback when right (optional)
\whenWrong . . . feedback when wrong (optional)
\end{question}

```

See the WebQuiz manual for details of the different comparison types. For example, button to to question 4 below was typed into WebQuiz using the following commands:

```

\begin{question}
  If the vectors  $\vec{a}$  (of magnitude 8 units) and  $\vec{b}$ 
  (of magnitude 3 units) are perpendicular, what is the value
  of
  \begin{displaymath}
    |\vec{a} - 2\vec{b}|^2
  \end{displaymath}
  (Hint: Draw a diagram!)

  \answer[number]{10}
  \whenRight The vectors  $\vec{a}$ ,  $-\vec{b}$ , and
   $\vec{a} - 2\vec{b}$  form the sides of a right-angled
  triangle, with sides of length 8 and 6 and
  hypotenuse of length  $|\vec{a} - 2\vec{b}|$ . Therefore
  by Pythagoras' Theorem,
   $|\vec{a} - 2\vec{b}| = \sqrt{8^2 + 6^2} = 10$ .

  \whenWrong Draw a diagram and then use Pythagoras' theorem.
\end{question}

```

**Index Files** (Index Files) WebQuiz also provides a mechanism for creating a web page containing an index of all quizzes for a given Unit of Study. This is done with a WebQuiz file that contains a `quizindex` environment. The syntax for this environment is as follows:

```

\begin{quizindex}
  \quiz[url1]{title for quiz 1}
  \quiz[url2]{title for quiz 2}
  . . .
\end{quizindex}

```

If no *URL* is given as an optional argument to `\quiz` then WebQuiz sets the url(s) to quiz1.html, quiz2.html and so on.

**Credits** (Credits) WebQuiz was written and developed in the *School of Mathematics and Statistics* at the *University of Sydney*. The system is built on L<sup>A</sup>T<sub>E</sub>X with the conver-



sion from L<sup>A</sup>T<sub>E</sub>X to HTML using Eitan Gurari's [TeX4ht](#), and Michal Hoftich's [make4ht](#).

To write quizzes using WebQuiz it is only necessary to know L<sup>A</sup>T<sub>E</sub>X, however, the WebQuiz system has three components:

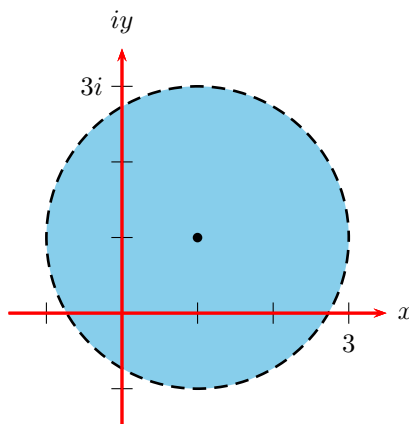
- A L<sup>A</sup>T<sub>E</sub>X document class file, `webquiz.cls`, and a [TeX4ht](#) configuration file, `webquitez.cfg`, that enable the quiz files to be processed by L<sup>A</sup>T<sub>E</sub>X and [TeX4ht](#), respectively.
- A python program, `webquiz`, that translates the XML file that is produced by [TeX4ht](#) into HTML.
- Some [Javascript](#) and [CSS](#) that controls the quiz web page.

The L<sup>A</sup>T<sub>E</sub>X component of WebQuiz was written by Andrew Mathas and the python, [CSS](#) and [Javascript](#) code was written by Andrew Mathas (and Don Taylor), based on an initial prototype of Don Taylor's from 2001. Since 2004 the program has been maintained and developed by Andrew Mathas. Although the program has changed substantially since 2004, Don's idea of using [TeX4ht](#), and some of his code, is still in use.

Thanks are due to Bob Howlett for general help with CSS and, for Version 5, to Michal Hoftich for technical advice.

### Question 1.

The shaded region in the graph



is equal to which of the following sets of complex numbers?

✗ Option 1(a):  $\{z \in \mathbb{C} : (z - 1)^2 + (z - (i + 1))^2 < 2\}$

*Feedback:* The equation of a circle in the complex plane with centre  $a + ib$  and radius  $r$  is

$$\{z \in \mathbb{C} : |z - (a + ib)| < r\}.$$

✗ *Option 1(b):*  $\{z \in \mathbb{C} : z + (i + 1) < 2\}$

*Feedback:* You want the set of points whose *distance* from  $1 + i$  is less than 2.

✓ *Option 1(c):*  $\{z \in \mathbb{C} : |z - (i + 1)| < 2\}$

*Feedback:* The graph shows the set of complex numbers whose distance from  $1 + i$  is less than 2.

✗ *Option 1(d):*  $\{z \in \mathbb{C} : |z - 2| < |i + 1 - 2|\}$

*Feedback:* As  $|i + 1 - 2| = \sqrt{2}$ , this is the set of complex numbers whose distance from 2 is less than  $\sqrt{2}$ .

✗ *Option 1(e):* None of the above.

*Feedback:* The graph shows the set of complex numbers whose distance from the centre of the circle is less than 2.

## Question 2.

Which of the following numbers are prime?

✗ *Option 2(a):* 1

*Feedback:* By definition, a prime is a number greater than 1 whose only factors are 1 and itself.

✓ *Option 2(b):* 19

*Feedback:* The only factors of 19 are 1 and itself.

✗ *Option 2(c):* 6

*Feedback:* 2 is a factor of 6

✓ *Option 2(d):* 23

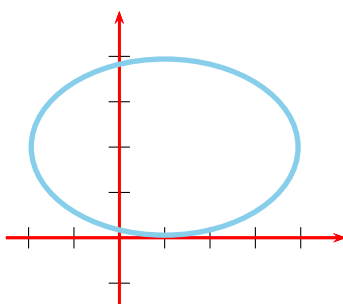
*Feedback:* The only factors of 23 are 1 and itself.

✓ *Option 2(e):* 191

*Feedback:* The only factors of 191 are 1 and itself.

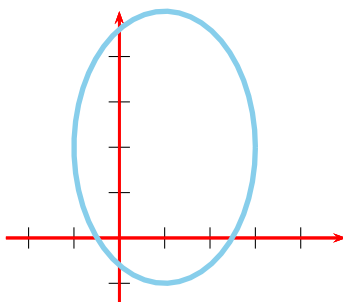
**Question 3.**

What are suitable parametric equations for this plane curve?



✗ *Option 3(a):*  $x = 2 \cos t + 1$ ,  $y = 3 \sin t + 2$

*Feedback:* This is an ellipse with centre  $(1, 2)$  and with axes of length 4 in the  $x$ -direction and 6 in the  $y$ -direction.

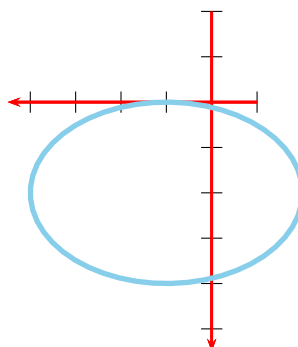


✓ *Option 3(b):*  $x = 3 \cos t + 1$ ,  $y = 2 \sin t + 2$

*Feedback:* The curve is an ellipse centre  $(1, 2)$  with axes length 6 in the  $x$  direction and 4 in the  $y$  direction.

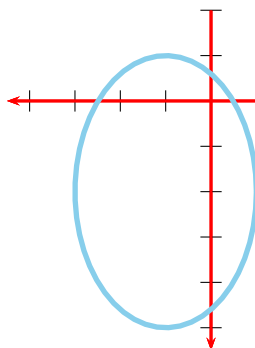
✗ *Option 3(c):*  $x = 3 \cos t - 1$ ,  $y = 2 \sin t - 2$

*Feedback:* This is an ellipse with centre  $(-1, -2)$  and with axes of length 6 in the  $x$ -direction and 4 in the  $y$ -direction.



✗ *Option 3(d):*  $x = 2 \cos t - 1, y = 3 \sin t - 2$

*Feedback:* This is an ellipse with centre  $(-1, -2)$  and with axes of length 4 in the  $x$ -direction and 6 in the  $y$ -direction.



#### Question 4.

If the vectors  $\mathbf{a}$  (of magnitude 8 units) and  $\mathbf{b}$  (of magnitude 3 units) are perpendicular, what is the value of  $|\mathbf{a} - 2\mathbf{b}|$ ? (Hint: Draw a diagram!)

Answer (number comparison): 10 units

*Feedback when right:* The vectors  $\mathbf{a}$ ,  $-2\mathbf{b}$ , and  $\mathbf{a} - 2\mathbf{b}$  form the sides of a right-angled triangle, with sides of length 8 and 6 and hypotenuse of length  $|\mathbf{a} - 2\mathbf{b}|$ . Therefore by Pythagoras' Theorem,  $|\mathbf{a} - 2\mathbf{b}| = \sqrt{8^2 + 6^2} = 10$ .

*Feedback when wrong:* Draw a diagram and then use Pythagoras' theorem.